

SECTION 3.1

Hydrology and Water Quality

3.1 Hydrology and Water Quality

3.1.1 Introduction and Summary

This section describes the existing conditions (i.e., current hydrology and water quality characteristics) in the Project region of influence that have the potential to be affected by the various Project Alternatives as well as the predicted impacts of those Alternatives. The geographic subregions in the region of influence that are addressed in this section include the LCR, IID Water Service Area and AAC, Salton Sea, and SDCWA service area. Surface waters in these areas consist of natural and engineered bodies of water and include permanent and ephemeral, and fresh and saline waters. Major water features described in this section include the Salton Sea; LCR; Alamo, New, and Whitewater Rivers; irrigation canals, such as the Coachella Canal, CRA, AAC, East Highline Canal, Central Main Canal, and Westside Canal; and the IID drainage system. Groundwater resources include fresh and saline waters beneath the geographic subregions listed above. A summary of the predicted impacts associated with the various Alternatives is provided in Table 3.1-1.

TABLE 3.1-1
Summary of Hydrology and Water Quality Impacts¹

Proposed Project: 300 KAFY All Conservation Measures	Alternative 1: No Project	Alternative 2: 130 KAFY On-farm Irrigation System Improvements Only	Alternative 3: 230 KAFY All Conservation Measures	Alternative 4: 300 KAFY Following Only
LOWER COLORADO RIVER				
WQ-1: Effects on groundwater, LCR flows, and LCR water quality: Less than significant impact.	Because LCR elevation is expected to remain within historic fluctuation there is no anticipated change in flows.	A2-WQ-1: Effects on groundwater, LCR flows, and LCR water quality: Less than significant impact.	A3-WQ-1: Effects on groundwater, LCR flows, and LCR water quality: Less than significant impact.	A4-WQ-1: Effects on groundwater, LCR flows, and LCR water quality: Less than significant impact.
IID WATER SERVICE AREA AND AAC				
WQ-2: Increased selenium concentration in IID surface drain discharges to the Alamo River: Significant and unavoidable impact.	Selenium concentrations are above significance criteria.	A2-WQ-2: Increased selenium concentrations in IID surface drain discharges to the Alamo River: Significant and unavoidable impact.	A3-WQ-2: Increased selenium concentrations in IID surface drain discharges to the Alamo River: Significant and unavoidable impact.	A4-WQ-2: Decreased selenium concentrations in IID surface drain discharges to the Alamo River: Beneficial impact.
WQ-3: Reduction in Total Suspended Solids concentrations in IID surface drains discharging to the Alamo River: Beneficial impact.	Continuation of existing conditions.	A2-WQ-3: Reduction in Total Suspended Solids concentrations in IID surface drains discharging to the Alamo River: Beneficial impact.	A3-WQ-3: Reduction in Total Suspended Solids concentrations in IID surface drains discharging to the Alamo River: Beneficial impact.	A4-WQ-3: Minor Reduction in total suspended solids concentrations in IID surface drains discharging to the Alamo River: No impact.

TABLE 3.1-1
Summary of Hydrology and Water Quality Impacts¹

Proposed Project: 300 KAFY All Conservation Measures	Alternative 1: No Project	Alternative 2: 130 KAFY On-farm Irrigation System Improvements Only	Alternative 3: 230 KAFY All Conservation Measures	Alternative 4: 300 KAFY Following Only
WQ-4: Increase in selenium concentration in the Alamo River at the Outlet to the Salton Sea: Significant and unavoidable impact.	Selenium concentrations are above significance criteria.	A2-WQ-4: Maintain selenium concentration in the Alamo River at the Outlet to the Salton Sea: Less than significant.	A3-WQ-4: Increased selenium concentration in the Alamo River at the Outlet to the Salton Sea: Significant and unavoidable impact.	A4-WQ-4: Decreased selenium concentration in the Alamo River at the Outlet to the Salton Sea: Beneficial impact.
WQ-5: Increase in selenium concentration in the IID surface drain discharge to the New River: Significant and unavoidable impact.	Selenium concentrations are above significance criteria.	A2-WQ-5: Increase in selenium concentration in the IID surface drain discharge to the New River: Significant and unavoidable impact.	A3-WQ-5: Increase in selenium concentration in the IID surface drain discharge to the New River: Significant and unavoidable impact.	A4-WQ-5: Maintain selenium concentrations in the IID surface drain discharge to the New River: Less than significant.
WQ-6: Change in COC concentrations in the New River at the Outlet to the Salton Sea: Less than significant impact.	Selenium concentrations are below the significance criteria.	A2-WQ-6: Change in COC concentrations in the New River at the Outlet to the Salton Sea: Less than significant impact.	A3-WQ-6: Change in COC concentrations in the New River at the Outlet to the Salton Sea: Less than significant impact.	A4-WQ-6: Decrease in COC concentrations in the New River at the Outlet to the Salton Sea: No impact.
WQ-7: Increase in selenium concentrations in the IID surface drains discharging directly to the Salton Sea: Significant and unavoidable impact.	Selenium concentrations are below the significance criteria.	A2-WQ-7: Increase in selenium concentrations in the IID surface drains discharging directly to the Salton Sea: Significant and unavoidable impact.	A3-WQ-7: Increase in selenium concentrations in the IID surface drains discharging directly to the Salton Sea: Significant and unavoidable impact.	A4-WQ-7: Decrease in selenium concentrations in the IID surface drains discharging directly to the Salton Sea: No impact.
WQ-8: Potential effects to Imperial Valley groundwater hydrology: Less than significant impact.	Groundwater quality and storage will remain within historic ranges.	A2-WQ-8: Potential effects to Imperial Valley groundwater hydrology: Less than significant impact.	A3-WQ-8: Potential effects to Imperial Valley groundwater hydrology: Less than significant impact.	A4-WQ-8: Potential effects to Imperial Valley groundwater hydrology: Less than significant impact.
HCP-IID-WQ-9: Wetland creation element of HCP provides additional high value water resource area: Beneficial impact.	The HCP will not be implemented under Alternative 1.	Same as HCP-IID-WQ-9: Beneficial impact.	Same as HCP-IID-WQ-9: Beneficial impact.	Same as HCP-IID-WQ-9: Beneficial impact.

TABLE 3.1-1
Summary of Hydrology and Water Quality Impacts¹

Proposed Project: 300 KAFY All Conservation Measures	Alternative 1: No Project	Alternative 2: 130 KAFY On-farm Irrigation System Improvements Only	Alternative 3: 230 KAFY All Conservation Measures	Alternative 4: 300 KAFY Fallowing Only
SALTON SEA				
WQ-10: Potential change in COC concentrations of Salton Sea water column: Less than significant impact.	Continuation of existing conditions.	A2-WQ-9: Potential change in COC concentrations of Salton Sea water column: Less than significant impact.	A3-WQ-9: Potential change in COC concentrations of Salton Sea water column: Less than significant impact.	A4-WQ-9: Potential change in COC concentrations of Salton Sea water column: Less than significant impact.
WQ-11: Potential change in COC deposition in Salton Sea sediments: Less than significant impact.	Continuation of existing conditions.	A2-WQ-10: Potential change in COC deposition in Salton Sea sediments: Less than significant impact.	A3-WQ-10: Potential change in COC deposition in Salton Sea sediments: Less than significant impact.	A4-WQ-10: Potential change in COC deposition in Salton Sea sediments: Less than significant impact.
HCP-SS-WQ-12: Reduced loading of COC to Salton Sea water and sediment: Less than significant impact.	The HCP will not be implemented under Alternative 1.	A2-HCP-SS-WQ-11: Reduced loading of COC to Salton Sea water and sediment: Less than significant impact.	A3-HCP-SS-WQ-11: Reduced loading of COC to Salton Sea water and sediment: Less than significant impact.	A4-HCP-SS-WQ-11: Reduced loading of COC to Salton Sea water and sediment: Less than significant impact.

¹ Programmatic level analyses of USFWS' biological conservation measures in LCR subregion are not summarized in the table because no significance determinations have been made. Subsequent environmental documentation will be required if potential impacts are identified.

3.1.2 Regulatory Framework

3.1.2.1 Federal Regulations and Standards

LOWER COLORADO RIVER

Federal regulations and standards that apply to the LCR include the following:

National Recommended Water Quality Criteria. Section 304(a) of the Clean Water Act (CWA), 33 USC§1314(a)(1), requires the U.S. Environmental Protection Agency (EPA) to publish and periodically update ambient water quality criteria. These criteria are to "...accurately reflect the latest scientific knowledge . . . on the kind and extent of all identifiable effects on health and welfare including, but not limited to, plankton, fish, shellfish, wildlife, plant life . . . which may be expected from the presence of pollutants in any body of water...." Water quality criteria developed under Section 304(a) are based solely on data and scientific judgments regarding the relationship between pollutant concentrations and environmental and human health effects. In accordance with this requirement, EPA has published a revised compilation of its ambient water quality criteria known as the National Recommended Water Quality Criteria—Correction (EPA 822-Z-99-001). The compilation contains criteria for the protection of aquatic life and human health for 157 pollutants. Federal and state water quality standards are typically based on the criteria presented in the National Recommended Water Quality Criteria—Correction (EPA 822-Z-99-001). These criteria

provide guidance for states and tribes to use in adopting water quality standards under Section 303(c) of the CWA. Such standards are used in implementing a number of environmental programs (nationally and in the LCR geographic subregion), including setting discharge limits for National Pollutant Discharge Elimination System (NPDES) permits. Even though these water quality criteria can be applied as standards and/or used in setting permit limitations, they are not regulations, and do not impose legally binding requirements on EPA, states, tribes, or the public.

Colorado River Basin Salinity Control Act (PL 93-320). Section 303 of the CWA (33 USC §1313) sets forth EPA requirements for water quality standards and implementation plans. In 1973, Arizona, Colorado, California, New Mexico, Nevada, Utah, and Wyoming (the Basin States) established the Colorado River Basin Salinity Control Forum for interstate cooperation and to communicate information necessary to comply with Section 303(a) and (b) of the CWA. In June of 1974, Congress enacted the Colorado River Basin Salinity Control Act (PL 93-320) with the Forum's support. The Salinity Control Act authorized the construction, operation, and maintenance of works in the Basin to control the salinity of water in the United States and delivered to users in Mexico. Subsequent amendments to PL 93-320 (i.e., PL 98-569 in 1984, PL 104-20 in 1995, PL 104-127 in 1996 and PL 106-459 in 2000) further increased the scope of the act to include components such as voluntary on-farm salinity control programs and salinity control cost reduction measures. In 1996, the Federal Agriculture Improvement and Reform Act (FAIRA) of 1996 amended the US Department of Agriculture's (USDA) role in salinity control by creating a new conservation program known as the Environmental Quality Incentives Program (EQIP), which combined four conservation programs, including the USDA's Colorado River Salinity Control Program.

Water Quality Standards for Salinity Control—Colorado River System. In 1974, EPA regulations set forth a salinity control policy for the Basin. The Basin States, acting through the Forum, initially responded to this regulation by developing and submitting "Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control—Colorado River System" to the EPA in 1975. Since the Basin States' initial adoption, the water quality standards have been reviewed every three years as required by Section 303(c)(1) of the CWA.

IID WATER SERVICE AREA AND AAC

In addition to the national water quality criteria in Section 304(a) of the CWA, specific federal laws, regulations, and criteria that could apply to waters potentially affected by the Proposed Project and Alternatives include the following:

Section 303(d) of the CWA, EPA Recommended Water Quality Criteria for TMDLs. Total Maximum Daily Loads (TMDLs) represent the greatest pollutant load that a water body can assimilate and still meet water quality standards and designated use criteria. Section 303(d)(1)(A) of the CWA requires states to identify waters that do not comply with applicable water quality standards. Impaired water bodies must be ranked, taking into account the severity of the pollution and the beneficial uses of such waters. Section 303(d)(1)(C) of the CWA requires states to establish TMDLs for those pollutants causing impairments to ensure that impaired waters attain their beneficial uses (see Section 3.1.2.2—State Regulations and Standards—for further details on proposed TMDL standards).

Section 402 of the CWA, NPDES (33 USC §1342). Section 402 of the CWA requires states to administer federal NPDES permit regulations for certain discharges into waters of the United States (such as the Alamo and New River). The NPDES permit program is intended to control and reduce pollutants to water bodies from point source discharges. As indicated in 40 CFR 122A, Section 122.1(b), the NPDES program requires permits for the discharge of pollutants from any “point source” into waters of the United States. “Point source” is defined in 40 CFR 122.2 as follows:

“Point source means any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.”

In accordance with the CWA, irrigation drainage as well as storm water runoff from agricultural fields is not within the definition of “point source.” Therefore, IID is exempt from the requirement to obtain a NPDES permit for agricultural discharges to the Alamo River, New River, and irrigation drains.

Section 401 of the CWA, Water Quality Certification (33 USC §1341). Section 401 requires states to certify that any activity that potentially discharges into navigable waters meets state water quality standards. This gives states the authority to deny or impose conditions on any activity that would adversely impact water quality.

Section 404 of the CWA, Dredge and Fill Permits (33 USC §1344). Waters of the US (including wetlands) are subject to US Army Corps of Engineers (Corps) jurisdiction under Section 404 of the CWA enacted in 1972 (as amended). Section 404 regulates the filling and dredging of waters of the US.

SALTON SEA

Applicable federal laws that regulate water quality in the Salton Sea include Sections 303(d), 401, 402 and 404 of the CWA (see discussion above). The following laws are also relevant to the Salton Sea:

Salton Sea Reclamation Act of 1998 (PL 105-372). In passing PL 105-372, Congress directed the Secretary of the Interior, acting through Reclamation, to conduct a feasibility study to reclaim the Salton Sea. The act directed the Secretary to complete all studies, including, but not limited to, environmental and other reviews, of the feasibility and benefit-cost of various options that permit the continued use of the Salton Sea as a reservoir for irrigation drainage and to:

- Reduce and stabilize the overall salinity of the Salton Sea;
- Stabilize the surface elevation of the Salton Sea;
- Reclaim, in the long term, healthy fish and wildlife resources and their habitats; and
- Enhance the potential for recreational uses and economic development of the Salton Sea.

“The Secretary was specifically directed to not include any option that relies on the importation of any new or additional water from the Colorado River or is inconsistent with the Law of the River. The legislative history of PL 105-372 acknowledged that:

“The Salton Sea itself has no right or priority to receive water from any source. Drainage and seepage waters that sustain the Sea are simply the incidental result of beneficial uses of water which are governed by existing laws, including the Law of the River” (House Report 105 621; Committee on Resources; Ordered to be printed July 14, 1998).

“Accordingly, the Secretary was directed to apply assumptions regarding water inflows into the Salton Sea Basin that encourage water conservation, account for transfers of water out of the Salton Sea Basin, and are based on a maximum likely reduction in inflows into the Salton Sea Basin which could be 800,000 acre-feet or less per year.”

The Secretary was directed to complete these studies by January 1, 2000. A Draft EIS/EIR was released by the Salton Sea Authority and Reclamation in January 2000 for the proposed Salton Sea Restoration Project; however, the Secretary has announced that a revised Draft EIS/EIR will be prepared.”

National Toxics Rule, 1992 (40 CFR 131.36) and California Toxics Rule (40 CFR 131.37) Section 304(a) and Section 307 (33 USC §1317) of the CWA. The National Toxics Rule (NTR) and California Toxics Rule (CTR) contain established ambient water quality criteria for aquatic life and human health for California, as they apply to inland surface waters such as the Salton Sea. The EPA promulgated numeric water quality criteria for priority toxic pollutants, and other provisions for water quality standards to be applied to waters in the State of California. EPA promulgated this rule based on the Administrator's determination that the numeric criteria are necessary in the State of California to protect human health and the environment. The rule fills a gap in California water quality standards that was created in 1994 when a state court overturned the state's water quality control plans containing water quality criteria for priority toxic pollutants. Thus, the State of California has been without numeric water quality criteria for many priority toxic pollutants as required by the CWA, necessitating this action by EPA. These federal criteria are legally applicable in the State of California for inland surface waters, enclosed bays, and estuaries for all purposes and programs under the CWA. The text of the CTR is located at 40 CFR 131.37. The actual numeric criteria for priority toxic pollutants for the State of California are cited at 40 CFR 131.38. The CTR does not change or supersede any criteria promulgated for the State of California in the NTR, as amended.

3.1.2.2 State Regulations and Standards

The Porter-Cologne Act, which is contained in Division 7 of the Water Code, establishes the responsibilities and authorities of nine Regional Water Quality Control Boards (RWQCBs) and the SWRCB. The Porter-Cologne Act names these boards “. . . the principal state agencies with primary control of water quality” (§ 13001). SWRCB formulates and adopts state policy for water quality control. RWQCBs develop water quality objectives and control plans that identify beneficial uses of water; establish water quality objectives (limits or levels of water constituents based on both state and federal laws); and define an implementation program to meet water quality objectives.

LOWER COLORADO RIVER

The following laws, along with specific state standards for priority pollutants (recently established through EPA's promulgation of CTR standards), apply to LCR waters:

Phase 1 of the Inland Surface Waters Plan, Enclosed Bays Estuaries Plan (ISWP/EBEP).

SWRCB approved Resolution 2000-015, thereby adopting the “Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California.” This policy establishes implementation procedures for discharges of priority pollutants to non-ocean surface waters of California. The goal of the policy is to establish a standardized approach for permitting discharges of toxic pollutants to non-ocean waters. The policy will be used in conjunction, where appropriate, with the development of TMDLs to ensure achievement of water quality standards. The majority of the priority pollutant standards are established in the CTR.

RWQCB’s Water Quality Control Plan (Basin Plan). The Basin Plan establishes water quality criteria and guidelines that protect human and aquatic life uses of the LCR geographic subregion. Specifically, the Basin Plan:

- Designates beneficial uses for surface water and groundwater;
- Sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and to conform to the state’s anti-degradation policy;
- Describes implementation programs to protect the beneficial uses of all waters in the region; and
- Describes surveillance and monitoring activities to evaluate the effectiveness of the Basin Plan.

Additionally, the Basin Plan incorporates, by reference, all applicable SWRCB and RWQCB plans and policies.

California Entitlements under the Law of the River. Over the years, common law (i.e., a group of federal and state laws, interstate compacts, an international treaty, court decisions, federal contracts, federal and state regulations, and multi-party agreements) has developed to collectively govern the use of Colorado River water. This body of law is commonly referenced as the “Law of the River.” California’s entitlements to Colorado River water are explained in detail in Section 1.

IID WATER SERVICE AREA AND AAC

California water quality regulations in the IID water service area are provided in the RWQCB Basin Plan. The Basin Plan also adopts water quality criteria provided by Minute No. 264 of the International Boundary and Water Commission. Minute No. 264 specifies qualitative and quantitative standards for the New River at the International Boundary. Other applicable regulations include:

ISWP/EBEP. See 3.1.2.2 discussion under State Regulations and Standards for the LCR.

Section 1601 of the California Fish and Game Code, Streambed Alteration Agreement.

Authorization (known as a Lake or Streambed Alteration Agreement) is required from CDFG for projects prior to any action that will: (1) divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake; (2) use materials from a streambed; or (3) result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake. The authorization requirement applies to any work undertaken in or near a river,

stream, or lake that flows at least intermittently through a bed or channel. This includes ephemeral streams, desert washes, and watercourses with a subsurface flow. It could also apply to any work undertaken within the flood plain of a body of water.

Approved Basin Plan Amendment for TMDLs. The New and Alamo Rivers are on the state's 303(d) list of impaired waters, and Section 303(d)(1)(c) of the CWA requires RWQCB to establish TMDLs for those pollutants causing impairments to ensure that impaired waters attain their beneficial uses. Pursuant to Sections 303(d)(1)(A) and 303(d)(1)(C), RWQCB has identified both the New and Alamo Rivers as water bodies that do not comply with applicable water quality standards, and has approved TMDLs for both rivers (see discussion under LCR federal regulations and standards in Section 3.1.2.1). Specifically, RWQCB has approved an amendment to its Basin Plan that establishes a TMDL of 200 milligrams per liter (mg/L) for total suspended solids (TSS) for the entire length of the US reach of the Alamo River. For the New River, TMDLs (30-day averages) of 200 membrane filter count most probable number (MPN)/100 ml for fecal coliform; 126 MPN/100 ml for E.Coli.; and 33 MPN/100 ml for Enterococci have been approved. Based on the targets listed above, the TMDL proposal establishes corresponding waste load allocations and load allocations for point and non-point sources of pollution, respectively (RWQCB 2001).

SALTON SEA

The Salton Sea is within the jurisdiction of RWQCB and, as such, would be subject to the ISWP/EBEP and the additional following state regulations:

Section 303(d) of the CWA. As discussed above, Section 303(d)(1)(C) of the CWA requires the RWQCB to establish TMDLs for impaired water bodies. The Salton Sea is on the state's 303(d) list of impaired water bodies. Therefore, TMDLs must be set for COCs in the Salton Sea. TMDLs to be established for the Salton Sea include salt (initiation date 1998; finish date 2001), selenium (initiation date 2002; finish date 2007), and nutrients (initiation date 2002; finish date 2010). Subsequent to development of TMDLs, the state must implement monitoring and management measures to reduce pollutant loading and improve water quality.

A revised CWA Section 303(d) list was approved in 2001 by the Regional Board and submitted to the State Board for consideration. The State Board will adopt a statewide 303(d) list in 2002, with subsequent revisions scheduled for every two years.

3.1.2.3 Local Regulations and Standards

Pertinent local standards and regulations that apply to the Proposed Project and Alternatives are primarily those found in the IID Rules and Regulations Governing the Distribution and Use of Water, which are published in accordance with Water Code § 22257. Water Code § 22257 reads in part as follows: "Each District shall establish equitable rules for the distribution and use of water, which shall be printed in convenient form for distribution in the District...."

3.1.3 Existing Setting

3.1.3.1 Lower Colorado River

The Colorado River is the principal source of water for domestic, municipal, industrial, agricultural, recreational, and hydroelectric purposes in Arizona, southern California, and southern Nevada. For the purposes of the Project, the LCR geographic subregion is defined as the area from Lake Havasu, including its inundation area at maximum operating pool elevation, to Imperial Dam as shown in Figure 3.1-1.

Monitoring the use and distribution of Colorado River water is required by the Decree. The Decree dictates, in addition to its other requirements, that the Secretary provide detailed and accurate records of diversions, return flows, and consumptive use of water diverted from the mainstream, “stated separately as to each diverter from the mainstream, each point of diversion, and each of the States of Arizona, California, and Nevada.” Reclamation provides the records annually in a report titled “Compilation of Records in Accordance with Article V of the Decree of the Supreme Court of the United States in *Arizona v. California*, Dated March 9, 1964” (Decree Accounting Report). The amount of water conserved under the Proposed Project would be measured as reduced consumptive use by IID in the Decree Accounting Report. Reclamation manages the water resources of the Colorado River on behalf of the Secretary (Reclamation 1999a).

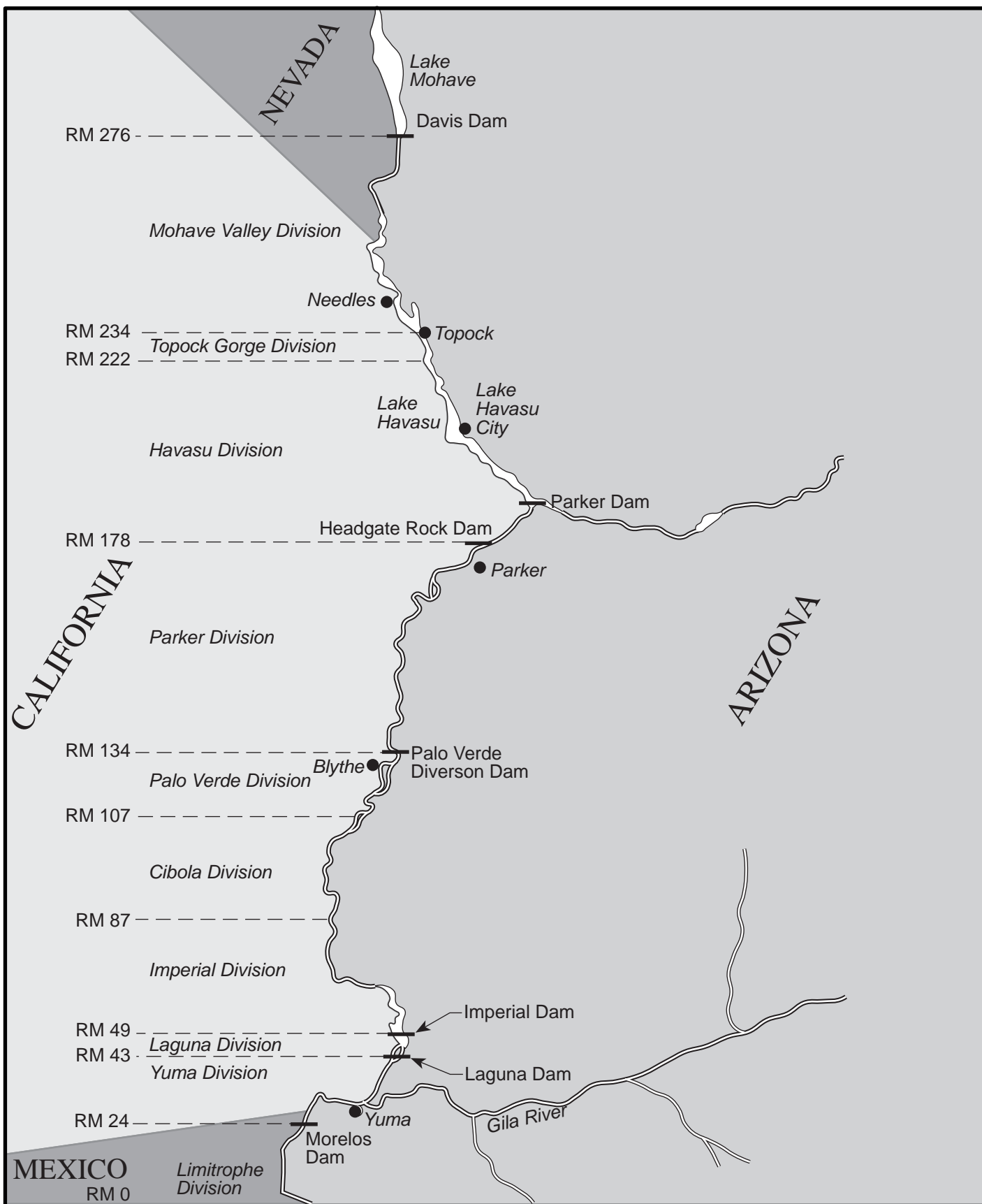
SURFACE WATER AND DAMS

Dams are critical to controlling the flow of the Colorado River and are the most influential structures on the LCR (see Figure 1-2 in Section 1). In-river dams retain all flow with the exception of water that is either diverted for irrigation or public supply; subject to infiltration, evaporation, or other elements of the hydrologic cycle; or released through the gates and spillways (Reclamation 2000a). Major dams within the LCR geographic subregion (and their years of completion) include, from north to south: Parker Dam (1938), Headgate Rock Dam (1944), Palo Verde Diversion Dam (1958), and Imperial Dam (1938). Reclamation operates Parker Dam, the Bureau of Indian Affairs operates Headgate Rock Dam, the Palo Verde Irrigation District operates Palo Verde Diversion Dam, and IID operates Imperial Dam (see Figure 3.1-1) (Reclamation 1999b).

The reach of the LCR from Parker Dam to Imperial Dam is approximately 143 miles long. For approximately 10 miles below Parker Dam to the Headgate Rock Diversion Dam, the Colorado River channel is confined within a steep valley. The water level is relatively stable over this short reach of the Colorado River because the reach is controlled at both ends (Reclamation 1999b).

Below Headgate Rock Dam the LCR flows through a 100 mile-long valley, which has been cut into the Parker, Palo Verde, and Cibola valleys. The Colorado River becomes more confined approximately 40 miles below Cibola Valley at Imperial Dam (Reclamation 1999b).

In addition to the control function played by dams along the LCR, the LCR is also confined within a system of stabilized riverbanks and levees (Reclamation 1999b). Channelization and stabilization activities have taken place for more than a century along the LCR.



RM River Mile

SOURCE: RECLAMATION

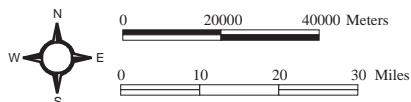


Figure 3.1-1
Facilities and Divisions
Lower Colorado River Area
IID Water Conservation and
Transfer Project Final EIR/EIS

Prior to construction of dams along the LCR, backwater lakes and wetland areas were maintained by frequent flood flows that flushed sediment downstream and sustained aerobic habitats important to native fish, wildlife, and vegetative species (DOI 1999). Today, many backwater lakes have filled with sediment and are no longer hydrologically connected to the river (Radtke et al. 1988). In the area just above the Imperial Dam, the Colorado River includes a diversion pool and backwaters (Figure 3.1-1). For the past 30 years, periodic dredging for silt removal has occurred within the diversion pool and backwater area above the Imperial Dam.

Descriptions of LCR surface water quantity and quality at Parker and Imperial Dams are provided below.

LCR at Parker Dam. Seventeen miles northeast of Parker, Arizona, Parker Dam spans the LCR between Arizona and California. Completed in 1938 by Reclamation, Parker Dam's primary purpose is to provide regulating storage capacity for the Colorado River in Lake Havasu while maintaining the reservoir pool above a minimum elevation from which water can be pumped into the CRA to the west and into the CAP to the east. Lake Havasu is approximately 45 miles long and spans 20,390 acres. It has a storage capacity of 648 KAF.

Water Quantity at Parker Dam. The discussion below regarding Parker Dam water quantity includes water diverted from Lake Havasu, releases from the dam, and LCR elevation below the dam.

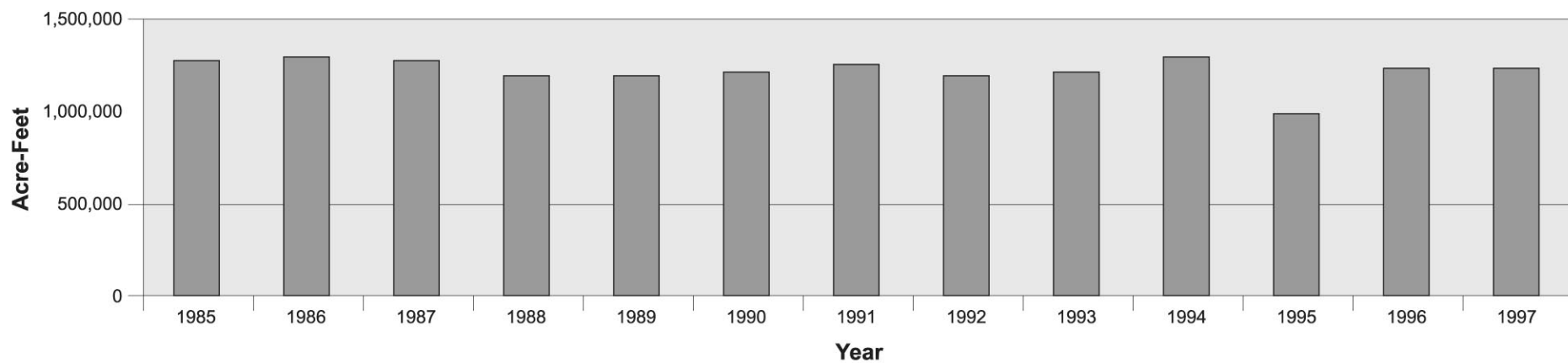
Diversion at CRA. MWD's Whitsett Pumping Plant, located 2 miles upstream from Parker Dam, lifts water from Lake Havasu into the CRA. Pumping by MWD began in 1939. During 1985 through 1997, annual CRA diversions at Parker Dam have ranged from a minimum of approximately 994 KAFY in 1995 to a maximum of approximately 1.3 MAFY in 1994, with an average annual CRA diversion of approximately 1.22 MAFY (Figure 3.1-2).

Diversion at CAP. Approximately 1.4 MAFY of water are currently diverted to the CAP from Lake Havasu (DOI 1999).

Releases at Parker Dam. Figure 3.1-3 presents recently (1985 through 1999) measured yearly releases below Parker Dam, ranging from a minimum of approximately 5.54 MAFY in 1993 to a maximum of approximately 16.3 MAFY in 1985, with an average annual release of approximately 8.66 MAFY.

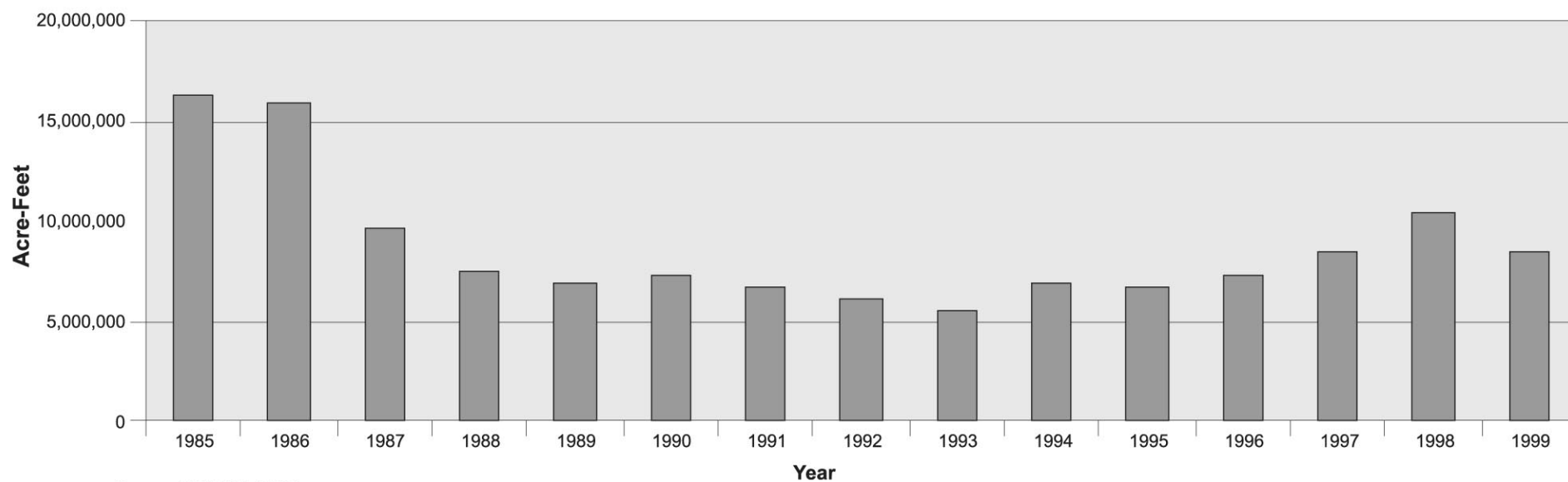
Average monthly releases during 1985 through 1999 varied seasonally, from a minimum of approximately 478 KAFY in November to a maximum of approximately 924 KAFY in July, with an average monthly release of approximately 721 KAFY.

Lake Havasu. Lake Havasu, the reservoir pool behind Parker Dam, has a maximum elevation of 450.54 feet above sea level. The reservoir was constructed by Reclamation with 100 percent funding from MWD as a component of its system to deliver Colorado River water to the coastal plain of southern California. The contractual arrangement between MWD and the United States includes a minimum reservoir pool elevation of 440.54 feet above sea level in order to provide for operation of MWD's intake from the Colorado River. Since then, the CAP intake was constructed on the Arizona shore of Lake Havasu. In general, however, recreational considerations keep the reservoir above 445 feet above sea level.



Source: DOI, 1999

Figure 3.1-2
Recent Amounts of Water Pumped by MWD
from Lake Havasu into the Colorado River
Aqueduct, 1985-1997 (AF)
IID Water Conservation and Transfer Project Final EIR/EIS



Source: CRB CA, 2000

Figure 3.1-3
Measured Yearly Flow, Colorado River Below
Parker Dam, at Gage 09427520, 1985-1999 (AF)
IID Water Conservation and Transfer Project Final EIR/EIS

Elevation of the Colorado River from Parker Dam to Imperial Dam. DOI calculated the average depth and width of water in the Colorado River at median and reduced flows (calculated at 18 percent below average to simulate low flow conditions in the Colorado River) and are presented in Table 3.1-2 (DOI 1999). At 11,000 cubic feet per second (cfs), average water depth between Parker and Imperial Dams ranges from 7.3 feet to 13.5 feet; and at 9,000 cfs, average water depth ranges from 6.7 feet to 13.4 feet. Reclamation has developed additional modeling of the LCR at additional flow levels; this modeling is described in the IA EIS (Reclamation 2002).

TABLE 3.1-2

Effect of Flow on Average Width and Depth of the LCR between Parker and Imperial Dams

Flow	Median Flow – 11,000 CFS		Lower Flow - 9,000 CFS ¹	
	Average Width (feet)	Average Depth (feet)	Average Width (feet)	Average Depth (feet)
Parker Dam to Headgate Rock Dam	611.7	13.5	606.6	13.4
Headgate Rock Dam to Palo Verde Diversion Dam	640.4	7.3	625.7	6.7
Palo Verde Diversion Dam to Imperial Dam	614.2	7.8	599.6	7.1

Source: DOI 1999

¹ 18% below average.

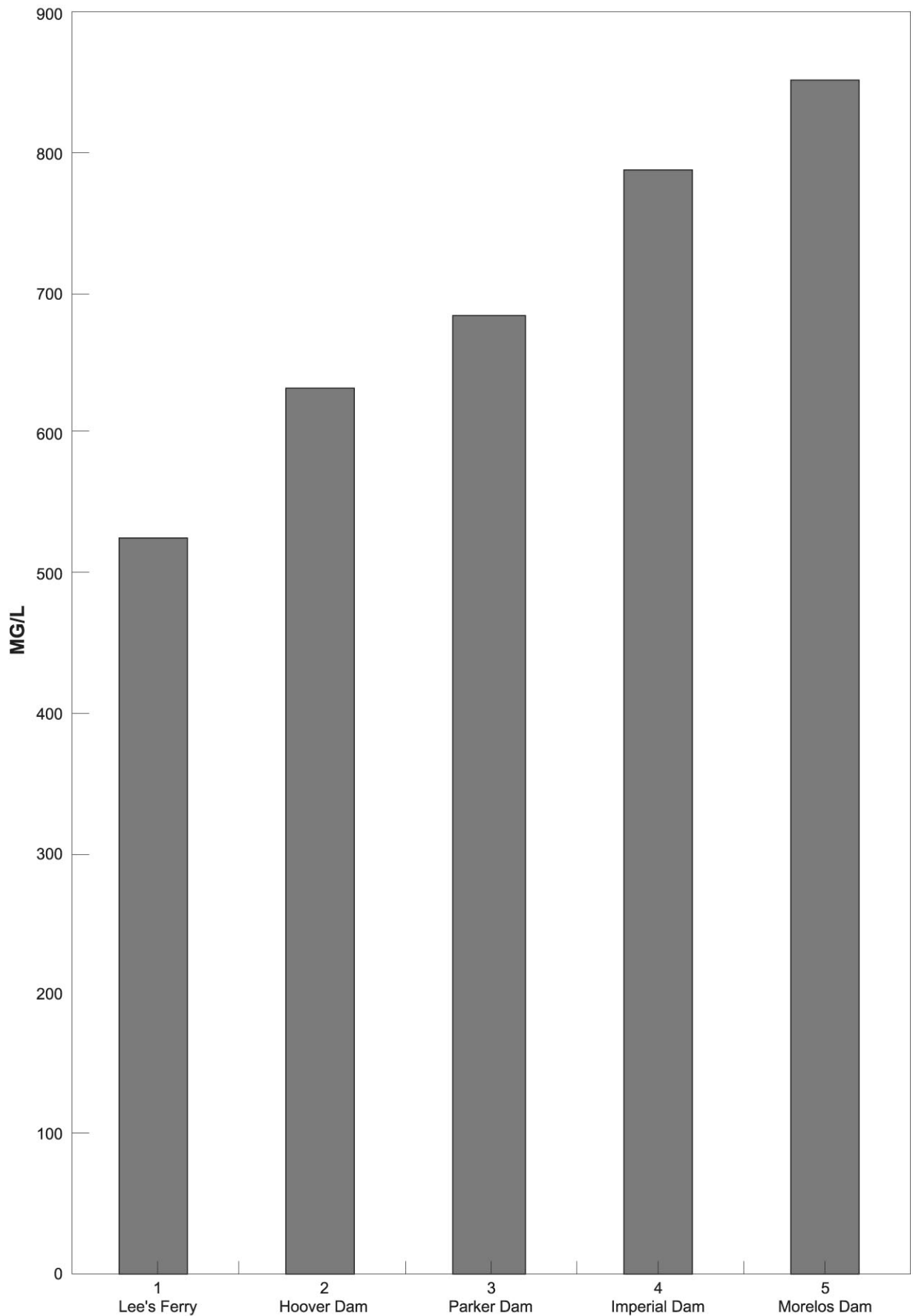
Water Quality at Parker Dam. According to the Basin Plan, water quality COCs in the LCR geographic subregion include TDS, selenium, TSS, organochlorine pesticides, water temperature, and other organic compounds and chemical constituents (Radtke et al. 1988, DOI 1999, and Reclamation 2000b and 2000c). A general description of TDS, selenium, and sediments is presented below.

Colorado River from Parker Dam to Imperial Dam.

TDS: The natural salinity regimen of the LCR is unknown but was likely similar to that observed during earlier years of sampling. Water composition and dissolved solids concentrations varied substantially daily, seasonally, and annually before the closure of Hoover Dam. Concentrations also varied substantially spatially (increasing with distance downstream) (Radtke et al. 1988).

Salinity results primarily from geologic sources, saline springs, and agricultural sources. Natural sources account for nearly half of the total salt load, and irrigation return flows add more than one-third; a minor part of the salt load is from industrial and municipal sources. At the Colorado River's source in the Rocky Mountains, the TDS concentration is typically 50 mg/L or lower. Large amounts of salts are picked up as the river flows downstream; at Hoover Dam, the river delivers about 9 million tons of salt in 10 MAF of water.

Figure 3.1-4 presents 1980-1997 TDS concentrations on the LCR between Lee's Ferry (north of Hoover Dam) and Morelos Dam (at the Northerly International Boundary [NIB]). The maximum value reported for TDS at Parker Dam was 811 mg/L, the minimum was



Source: USGS, 2000

Figure 3.1-4
Average Total Dissolved Solids from
Lee's Ferry to Morelos Dam, 1980-1997
IID Water Conservation and Transfer Project Final EIR/EIS

384 mg/L, with an average TDS value of 682 mg/L. The maximum value reported for TDS at Imperial Dam was 982 mg/L, the minimum was 568 mg/L, with an average TDS value of 768 mg/L.

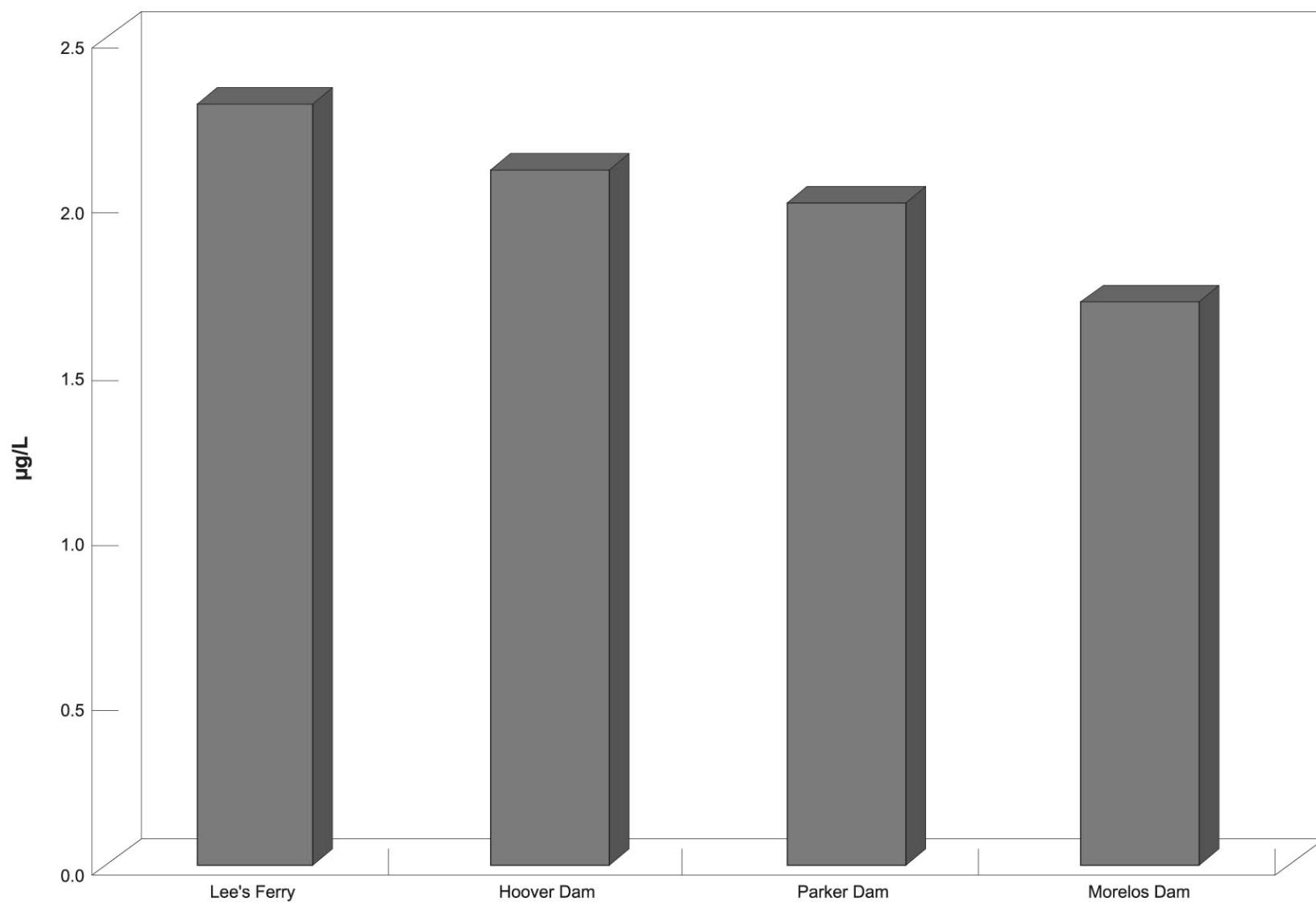
Selenium: Dissolved selenium in the LCR from Parker Dam to Imperial Dam appears to be derived from sources in the Upper Basin above Lee's Ferry and exists in small dissolved concentrations (less than 1 to 2 micrograms per liter [$\mu\text{g/L}$]). Figure 3.1-5 presents United States Geological Survey (USGS) data regarding dissolved selenium concentrations on the LCR between Lee's Ferry and Morelos Dam, including concentrations at Parker Dam during 1991 to 1997. Figure 3.1-5 shows that selenium concentrations are reduced downstream. Concentrations reported at Parker Dam ranged from a minimum of 1.0 micrograms per liter ($\mu\text{g/L}$) to a maximum of 3.0 $\mu\text{g/L}$, with an average concentration of 2.0 $\mu\text{g/L}$ (Reclamation 2000c).

Selenium in bottom sediments of the LCR between Parker and Imperial Dam was also reported. The concentrations of selenium between Parker and Imperial Dam in bottom sediment (1985 and 1986) ranged from a minimum of 0.03 micrograms per gram ($\mu\text{g/g}$) at Palo Verde Diversion Dam to a maximum of 7.1 μg at Imperial Dam. Mainstream Colorado River sediment, less than 63 μg in diameter, appeared to act as a sink for selenium, especially in backwater areas with higher concentrations of organic matter (Radtke et al. 1988).

Sediments: Historically, the Colorado River was known for its ability to transport enormous sediment volumes. Following the completion of Hoover Dam, the annual cycle of high and low flows was replaced with regulated flow discharges, as required to meet the needs of water users. Sediment now accretes in reservoirs and desilting basins and is mechanically removed from the river (Reclamation 1999b). Annual historical sediment loads for Parker Dam, Imperial Dam, and near the City of Yuma, Arizona, are presented in Figure 3.1-6. Although estimates of pre-dam sediment loading were not established for Parker and Imperial Dams, data from the Yuma site shows a very significant decrease in sediment load corresponding to the period of dam closure (Reclamation 1999b).

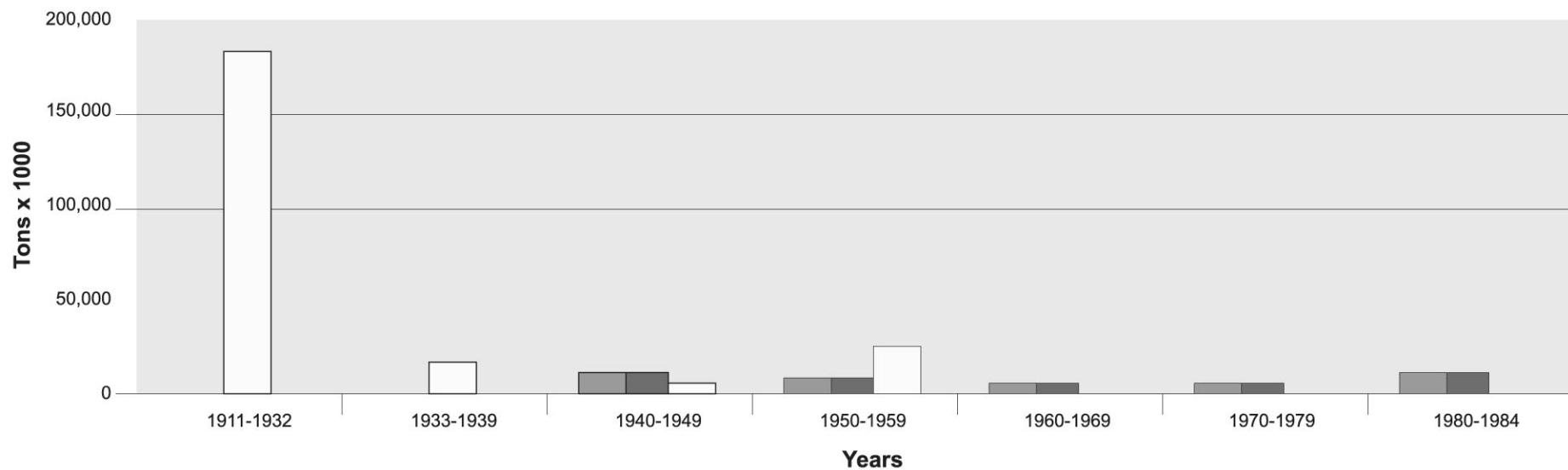
Additional TSS data are available from USGS for two stations on the LCR between Parker and Imperial Dams: USGS 09427520—Colorado River Below Parker Dam, CA-AZ; and USGS 09429490—Colorado River Above Imperial Dam, CA-AZ. Because the sampling at both locations was sporadic and nonexistent in some years, and because turbidity can vary seasonally and with flow, the data were deemed incomplete/inconclusive but are included for disclosure purposes in Appendix F. The TSS concentrations at Parker Dam ranged from 0.9 mg/L (1989) to 37 mg/L (1979), with the average annual concentration varying from 1.55 mg/L (1991) to 8.2 mg/L (1979).

LCR at Imperial Dam. Imperial Dam is located approximately 18 miles northeast of Yuma, Arizona. Construction of the dam and desilting works was completed in 1938. The dam diverts LCR water via the AAC on the west to the Imperial and Coachella valleys, Yuma Project Reservation Division, and Yuma Valley; and via the Gila Gravity Main Canal on the east. In California, the AAC serves the Yuma Project Reservation Division in the Bard Valley in addition to the Imperial and Coachella valleys. In Arizona, the AAC serves the City of Yuma, the Yuma Project Valley Division in the Yuma Valley, and the Cocopah Indian Reservation. Additional areas in Arizona served by the Gila Gravity Main Canal consist of



Source: USGS 1991-Present

Figure 3.1-5
Dissolved Selenium,
Lee's Ferry to Morelos Dam, 1991-1997
IID Water Conservation and Transfer Project Final EIR/EIS



Source: Reclamation, 1999

LEGEND

- Parker Dam
- Imperial Dam
- Yuma, AZ

Figure 3.1-6
Annual Historic Sediment Loads for
Parker Dam, Imperial Dam, and Yuma, AZ
Lower Colorado River (1911-1984)
 IID Water Conservation and Transfer Project Final EIR/EIS

portions of the lower Gila Valley served by the North Gila Valley Irrigation and Drainage District and the Yuma Irrigation District, portions of the Yuma Mesa served by the Yuma Mesa Irrigation and Drainage District and the Unit “B” Irrigation and Drainage District, and portions of the Gila River Valley upstream of Dome served by the Wellton-Mohawk Irrigation and Drainage District.

Closure of Imperial Dam raised the water surface level to 181 feet above mean sea level (msl), or 23 feet higher than the original river’s level. The dam was designed to provide a maximum diversion of 15,155 cfs to the AAC and 2,200 cfs to the Gila Gravity Main Canal, and to pass a maximum flood of 180,000 cfs (DOI 1999).

Water Quantity at Imperial Dam. The discussion below regarding Imperial Dam water quantity includes water diverted upstream of the dam, releases from the dam, and LCR elevation at the dam.

Diversion at Headgate River Diversion Dam. The Colorado River Indian Reservation holds present perfected rights with a priority dating from the late 19th century. From 1986 to 2000, average diversions into the Parker Valley of Arizona, where the bulk of the Colorado River Indian Reservation’s present perfected rights are held, amounted to approximately 626 KAFY. Of this amount, an average of approximately 248 KAFY was returned to the river by surface flow (Howard F. McCormack. USGS-WRD, Personal communication with Elizabeth Cutler, CH2M HILL, December 14, 2001).

Diversion at Palo Verde Diversion. Palo Verde Irrigation District holds the earliest formal district appropriation of LCR water. From 1986 to 1999, the Palo Verde Irrigation District diverted an average of 874,000 acre-feet of water from the Colorado River to approximately 100,000 acres of land growing primarily alfalfa, cotton, melons, lettuce, and wheat. Of this amount, an average of approximately 454 KAFY was returned to the river by surface flow.

Diversion at AAC. Table 3.1-3 shows the annual average gross diversion from the Colorado River into the AAC and the distribution of that flow for the 12-year period 1987 to 1998.

Thus, water delivered for use in the Imperial and Coachella valleys accounts for approximately 64 percent of the gross amount of Colorado River water diverted into the AAC. From 1986 through 1998, an average of 2.87 MAFY of Colorado River water was delivered to the Imperial Valley via the AAC (see Figure 3.1-7). As measured at AAC Drop No. 1, the minimum quantity was approximately 2.48 MAF in 1992; the maximum was approximately 3.12 MAF in 1996. The flow quantity and water quality of the AAC is discussed in Section 3.1.3.2, IID Water Service Area and AAC.

Flow at Imperial Dam. Measured annual flow at Imperial Dam during 1985 to 1999 ranged from approximately 4.76 MAF in 1993 to approximately 15.0 MAF in 1985, with an average flow of approximately 7.59 MAFY (see Figure 3.1-8).

The average monthly flow at Imperial Dam varied seasonally during 1985 to 1999. Monthly average flow at Imperial Dam has varied from a minimum of approximately 460 KAF in November, to a maximum of approximately 750 KAF in July, with an average monthly flow of approximately 632 KAF.

TABLE 3.1-3

Annual Average Gross Diversion from Colorado River into AAC (1987-1998)

Diversion	Flow (AFY)	Percent of Gross Diversion
AAC Gross Diversion	5,092,884	---
Yuma Main Canal turnout to the City of Yuma, Arizona, the Cocopah Indian Reservation, and the Yuma Project in Arizona and California; and for additional hydroelectric power generation through the Syphon Drop Power Plant ¹	596,067	12
Sum of Small turnouts to Yuma Project Reservation Division in California	83,531	2
Releases for hydroelectric power generation through the Pilot Knob Power Plant and Wasteway ¹	981,965	19
AAC below Pilot Knob Check to IID and CVWD	3,292,366	64
Conveyance loss from Imperial Dam to Pilot Knob Check	138,955	3

¹Water diverted for the sole purpose of hydroelectric generation at Syphon Drop Power Plant and Pilot Knob Power Plant is returned to the Colorado River above the NIB.

Source: US Geological Survey streamflow records

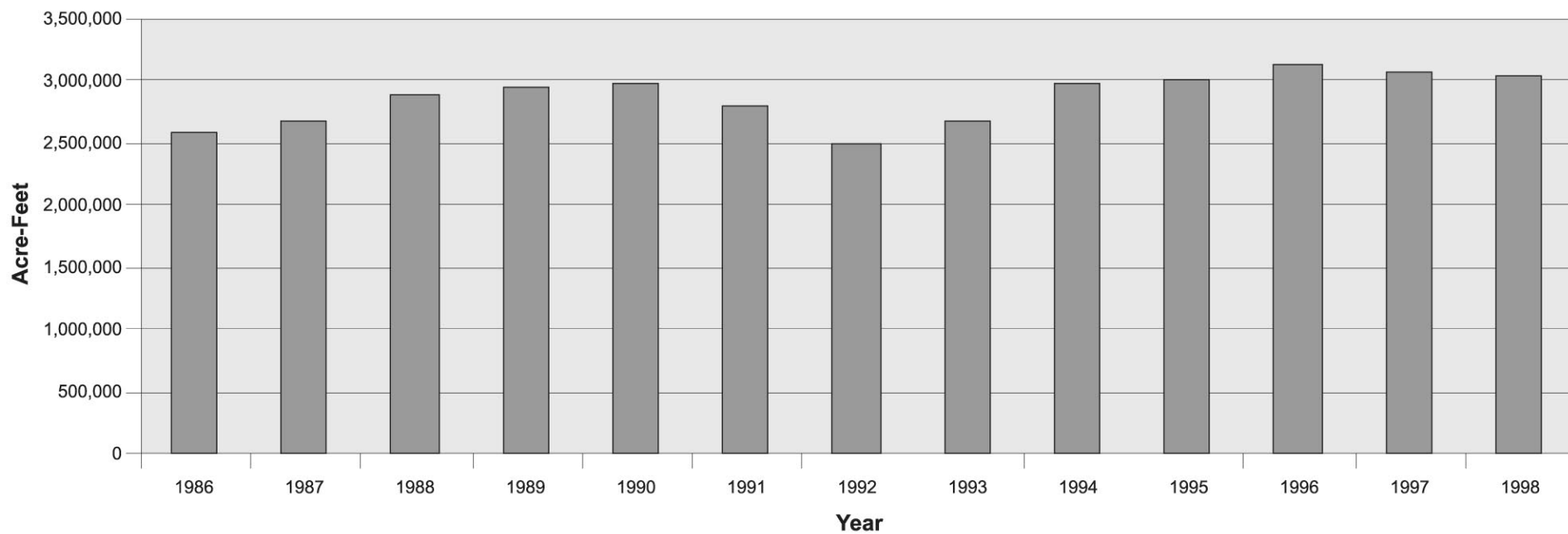
Elevation at Imperial Dam. The surface elevation of the pool behind Imperial Dam is maintained at an elevation necessary to provide for diversion into the AAC and the Gila Gravity Main Canal, typically within a range of 180.80 feet to 180.00 feet above sea level, and occasionally ranges as low as 178.3 feet (Personal communication, Bobby Moore/IID to Elizabeth Cutler/CH2M HILL, December 13, 2001).

Water Quality at Imperial Dam. Individual water quality COCs in the LCR geographic subregion include: TDS, selenium, sediments, organochlorine pesticides, water temperature, and other organic compounds and chemical constituents (Radtke et al. 1988, DOI 1999, and Reclamation 2000b and 2000c). A general description of TDS, selenium, and sediments are presented below.

TDS. TDS concentrations in the LCR vary from year to year, depending on the amount of runoff from the Colorado River Basin. TDS in the LCR at Imperial Dam are discussed previously in this section, under the following headings: LCR at Parker Dam- Water Quality; Parker Dam- TDS, and are presented in Figure 3.1-4.

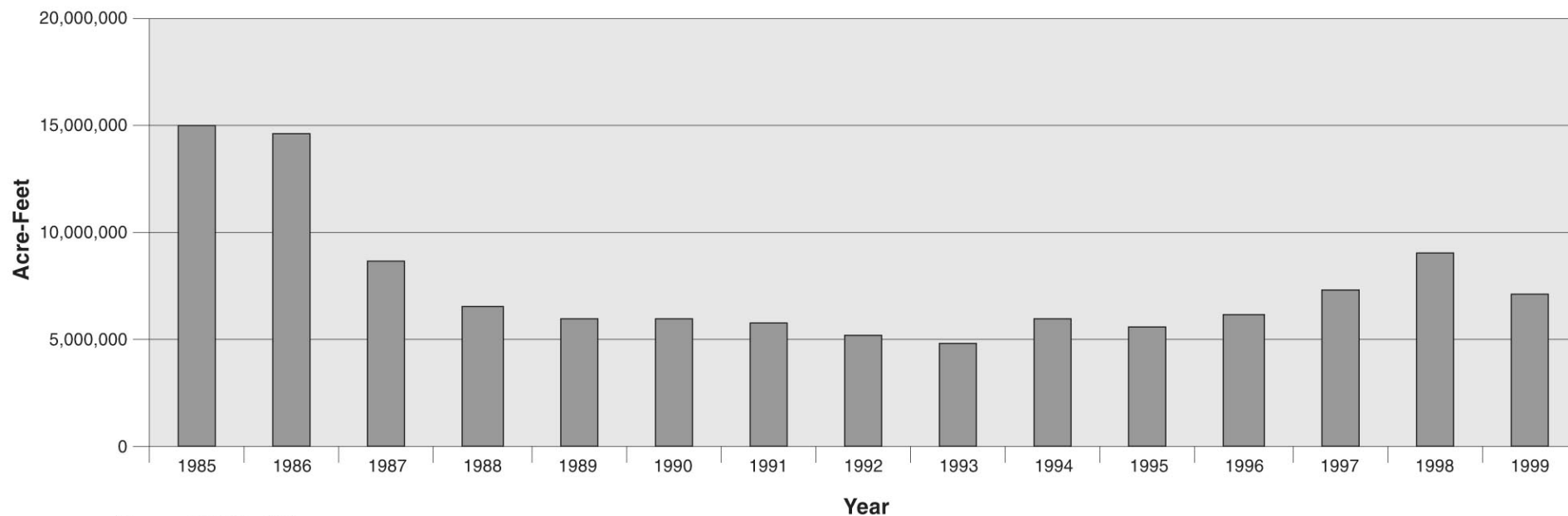
Selenium. Dissolved selenium and selenium in bottom sediments of the LCR at Imperial Dam are discussed previously in this section, under the headings: LCR at Parker Dam- Water Quality; Parker Dam- Selenium, and are presented in Figure 3.1-5.

Sediments. LCR sediments at Imperial Dam are discussed in the Parker Dam water quality section and are presented in Figure 3.1-6. Additional TSS data are available from USGS for two stations on the LCR between Parker and Imperial Dams: USGS 09427520— Colorado River Below Parker Dam, CA-AZ and USGS 09429490—Colorado River Above Imperial Dam, CA-AZ. Because the sampling at both locations was sporadic and nonexistent in some



Source: IID, 1999

Figure 3.1-7
Flow in the All American Canal
at Drop No. 1, 1986-1998 (AF)
IID Water Conservation and Transfer Project Final EIR/EIS



Source: CRB CA, 2000

Figure 3.1-8
Measured Yearly Flow, Colorado River
Above Imperial Dam, at Gage 09429490, 1985-1999 (AF)
IID Water Conservation and Transfer Project Final EIR/EIS

years, and because turbidity can vary seasonally and with flow, the data were deemed incomplete and inconclusive; however, the data are included for disclosure purposes as Appendix F. The maximum reported TSS concentration at Imperial Dam ranged from 5 mg/L (1996) to 559 mg/L (1998), with the average annual concentration varying from 9 mg/L (2000) to 206.4 mg/L (1998).

GROUNDWATER

Groundwater Quantity. The flood plain and adjacent alluvial slopes in the LCR geographic subregion are underlain by the Colorado River aquifer, which ranges in thickness from zero to over 5,000 feet (Owens-Joyce and Raymond 1996). The aquifer consists of four hydrologic units composed of partly saturated younger alluvia and older alluviums. The alluvium includes the Chemehuevi Formation, Bouse Formation, fanglomerate, and Muddy Creek Formation. These overlie nearly impermeable bedrock, and are hydraulically connected to the LCR. The amount of water that flows between the Colorado River and the aquifer varies in response to fluctuations in their individual water level elevations. Generally, groundwater is unconfined in all four hydrologic units along the LCR; however, confined zones are likely to be present as well (RWQCB and SWRCB 1994, Robertson 1987).

From Lake Havasu to Imperial Dam, water moves between the river and the aquifer in response to differences in water level elevations between the river and the aquifer. Withdrawals through wells located within the Colorado River flood plain are replaced by water from the river. In the uplands extending from the flood plain, the USGS has identified the extent of an “accounting surface” from which groundwater wells have the potential to withdraw water that would be replaced by water from the Colorado River (USGS 1994). Significant amounts of water diverted for irrigation within the flood plain or the accounting surface percolates back to the Colorado River through subsurface drainage. Subsurface tributary inflow occurs beneath the Bill Williams River and some desert washes. However, the combination of groundwater withdrawals and phreatophytes result in a net loss of water from the Colorado River aquifer in the LCR area that is replaced by water from the Colorado River (USGS 1994).

Within the East Colorado River Basin Planning Area, about 10 KAFY of precipitation deep percolates into the groundwater. The combined groundwater storage capacity of all hydrologic units in the planning area is approximately 35 MAF within a 200-foot zone, above the deepest well in each hydrologic unit. Wells are more than 300 feet deep in three of the hydrologic units (RWQCB and SWRCB 1994).

Tributary groundwater inflow to the LCR between Parker and Imperial Dams is extremely low; therefore, the surface elevation of the LCR typically directly affects the elevation of the water table within the river aquifer. Additionally, near-river groundwater levels can be directly affected by irrigation wells adjacent to the LCR, which pump several cubic feet of water per second (DOI 1999).

Groundwater elevations in the Yuma area are influenced by the following factors:

- Recharge from the Colorado River between Laguna Dam and Morelos Dam;
- Recharge from the Colorado River below Morelos Dam;

- Recharge from facilities that convey water from the Colorado River to irrigate lands in the Bard, Imperial, and Coachella valleys in California, the Yuma Valley in Arizona, and the Mexicali Valley in Mexico;
- Recharge from the application of water to agricultural lands in the Bard Valley in California, the Yuma Valley in Arizona, and the Mexicali Valley in Mexico; and
- Groundwater withdrawals from the Mexicali Valley and Yuma Valley.

Of these factors, recharge from the Colorado River below Morelos Dam is the most variable. Typically, there is little or no flow in the Colorado River below Morelos Dam unless there are significant excess deliveries to Mexico resulting from flood control releases at Hoover Dam or high tributary flows below Hoover Dam (MWD 2000).

Sedimentation in the Colorado River is a factor in groundwater levels in the Yuma area. The Gila River flood of 1993 deposited approximately 10 million cubic yards of sediment in the Colorado River bed from its confluence with the Gila River to Morelos Dam. This sedimentation raised the bed of the river by approximately 5 feet and has resulted in higher groundwater levels beneath the Yuma and Gila valleys (Reclamation 1999c).

Groundwater Quality. Adequate historical water quality data are unavailable, which has limited RWQCB's ability to establish specific groundwater quality objectives. In most cases, groundwater that is pumped generally returns to the LCR with increased mineral concentrations, including TDS, nitrate, and other COCs. (RWQCB and SWRCB 1994).

3.1.3.2 IID Water Service Area and AAC

SURFACE WATER

Surface water within the IID water service area comes primarily from two sources: the Colorado River, and inflow across the International Boundary from Mexico (via the New River). However, agriculture served by IID is entirely dependent on its diversions from the Colorado River into the AAC at Imperial Dam. The following sections describe IID's irrigation and drainage systems and provide details on surface water quantity and quality within the IID water service area.

IID Irrigation System. IID's irrigation system delivers water to more than 7,000 farms on about 460,000 acres of irrigated land. IID's irrigation system serves two primary purposes: (1) to replenish moisture in the crop root zone; and (2) to leach accumulated salts from the soils. Approximately 16 percent of irrigation water delivered to fields is discharged through tilewater and contributes to leaching of salts accumulated in the soils.

Approximately 69 percent of the water that is delivered for on-farm use is used consumptively (i.e., 66 percent is used by crops and roughly 3 percent is lost to evaporation from soil or water surfaces). The remaining 31 percent discharges into IID's drainage system as tailwater and tilewater (29 percent), which is described below, or is lost to shallow groundwater (2 percent) (IID 1994).

IID's irrigation system begins at the point where Colorado River water is diverted at Imperial Dam. After being desilted, the water is then conveyed by gravity from Imperial Dam through the 82 mile AAC. The AAC discharges water to several turnouts—the Yuma Main Canal and several smaller turnouts for the Yuma Project Reservation Division, Pilot